

Using the Forecast Status in VDV454

Extension to all the realisation guide VDV Leaflet 454

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1. Management Summary

The current definitions concerning Real Times in VDV Leaflet 454 are for ever leading to discussion as to their correct interpretation. Only if the forecast status elements, i.e. (`IstAnkunftPrognoseStatus` and `IstAbfahrtPrognoseStatus`), are correctly interpreted and used by all partners will the corresponding degree of added value be achieved and the requirements of the Federal Office of Transport (FOT) met.

This document will now explain how Real Times (defined in Switzerland as essential) as understood by Swiss public transport companies can be subscribed to, transmitted and handled.

1.1. The aim and purpose of Real Times

Real Times are transmitted in pursuit of various aims and purposes:

1. Transmitting Real Times immediately an arrival and departure event occurs tells the recipient of the data exactly where the vehicle is when an arrival and departure event is triggered. There are decisive advantages to this if, for example, there is a need to calculate a connecting service or make a change in accordance with VDV453-DFI [1] or VDV453-ANS [1].
2. Transmitting Real Times immediately is not needed for statistical purposes; however, they can be used to analyse exact arrival and departure times and connections. This is the only way to ensure that Real Times are always transmitted in respect of all station stops on a journey, and also, for example, for the final arrival.

1.2. Applicability

This document applies to all XSDs (2015, 2017 and all later issues) to VDV Leaflet 454 used in Switzerland in which the forecast status element is used.

2. Subscription (AboAus)

In AboAUS, the `MitRealZeiten` element controls whether the customer wants or does not want to receive Real Times (Status `REAL`) immediately an arrival or departure event occurs.

2.1. MitRealZeiten

Value	Description
<code>true</code>	<p>The customer/subscriber requests that Real Times are supplied directly/immediately an arrival or departure event occurs. The requirement in CUS about supplying Real Times will have been met if the supplier is in fact able to supply Real Times. Currently, CUS already places orders with all partners using the parameter <code>MitRealZeiten=true</code> wherever this parameter has been fully implemented.</p> <p><i>Explanation:</i> If <code>true</code>, the ITCS must transmit the actual arrival and departure times using <code>PrognoseStatus=Real</code> directly/immediately an arrival or departure event occurs. If the ITCS does not support this, the subscription will be accepted but will move automatically to <code>false</code>.</p> <p>The triggers for arrival and departure events are described in Section 6.1.</p>
<code>false</code>	<p>(default) The customer/subscriber does not want Real Times to be supplied directly/immediately an arrival or departure event occurs. The requirement in CUS regarding supplying Real Times has not been met. This value may, therefore, only be used by customers of CUS.</p> <p><i>Explanation:</i> Transmitting real time data immediately can, to an extent, massively increase the data volume to be transmitted. Customers of CUS should therefore carefully consider whether they really do need Real Times to be supplied immediately an arrival or departure event occurs or not.</p> <p>By using the value <code>false</code>, the source system will supply new data whenever any message-triggering events occur (see Section 6.1.4) except for arrival or departure events.</p>

3. Forecast status

The forecast status describes the forecast times more precisely, for example whether the 'forecast time' is a Real Time or an actual time for an arrival or departure which has already taken place or whether it is a forecast for an arrival or a departure which has already taken place or which lies in the future, etc.

3.1. Description of the forecast status

The element `MitRealZeiten=true/false` controls whether a message will or will not be triggered immediately an arrival or departure event occurs. This element will not affect which values in the forecast status are transmitted.

Quotation taken from VDV Leaflet 454, Section 6.1.11:

... The ITCS transmits an actual time as soon as the event (arrival at or departure from the station stop) has taken place. ...

For example:

- In the case of `MitRealZeiten=false`, the value `Real` may also be transmitted in the forecast status. However, this will not be transmitted immediately an arrival or departure event occurs but will be based on other message-triggering events; see Section 6.1.4.
- In the case of `MitRealZeiten=true` too, the values `Prognose` (even for arrivals and departures which have already taken place) and `Unbekannt` may be transmitted in the forecast status, if it is not possible to ascertain more exact times.

Description of status:

Value	Description
Prognose	(default) The time stated is a forecast of the time of a past or future arrival or departure where no arrival or departure event has yet taken place (independently of the element <code>MitRealZeiten</code>). In the absence of an arrival or departure event, it is not possible to ascertain whether a station stop has in fact been approached or where exactly the vehicle is. The vehicle could have by-passed an earlier station stop without the ITCS having taken note of this. If an arrival or departure event has been triggered for this forecast time, this status may not be used. Instead, the forecast status <code>Real</code> must be transmitted together with a Real Time. A forecast in the past is always a former forecast or an estimate. If a forecast at an earlier station stop is transmitted with an arrival or departure time which has already taken place, then the recipient system can assume that the journey has already passed this arrival or departure point. This information can be used to ensure a connecting service, for example.
Geschaetzt	This status can be set if the control system is certain that this arrival or departure point has already been passed or at least that it will no longer be approached. Instead of <code>Geschaetzt</code> , it is always possible to set <code>Prognose</code> . If this status cannot be reliably transmitted, the advantage of <code>Geschaetzt</code> over <code>Prognose</code> is minimal.

Value	Description
Real	<p>The time shown is the Real Time of an earlier arrival, departure or transit where an arrival, a departure or a transit event has taken place and the corresponding Real Time has been transmitted. This is independent of whether the message was issued immediately (<code>MitRealZeiten=true</code>) or only later (<code>MitRealZeiten=false</code>).</p> <p>Arrivals, departures or transits with the forecast status <code>Real</code> and which have already taken place are, as specified in Section 6.1.11 of VDV Leaflet 454, generally transmitted only once (or possibly once more as part of complete journey messages).</p>
Unbekannt	<p>This forecast status may be used for a future arrival or departure or for one which has already taken place. The forecast status <code>Unbekannt</code> refers to a whole journey or to part of a journey where only the scheduled times are known but any deviation from them is not known. If the forecast status is <code>Unbekannt</code> neither <code>IstAnkunftPrognose</code> nor <code>IstAbfahrtPrognose</code>, but only the scheduled times may be sent. Although the scheduled times are sent, they must not be adopted as a forecast time. In such a case, the scheduled time may be used for purposes of relevance to passengers, e.g. route changes or ensuring connecting services. Exactly how much this journey has progressed towards this arrival or departure cannot be ascertained either by the ITCS or by the information system; this fact must be taken into account when making calculations. The result should be flagged up accordingly.</p> <p>Arrivals and departures which have already taken place and which have the forecast status <code>Unbekannt</code> will not, as a general rule, be corrected again even if further messages about this journey are received because neither forecast times nor Real Times are available. This status will be used if the ITCS cannot ascertain a sensible time for a future arrival or departure or one which has already taken place; e.g. if the station stop has not been approached or if neither a forecast time nor a Real Time (measured time) is available.</p> <p><i>Note:</i> If the forecast status is <code>Prognose</code>, the <code>IstAnkunftPrognose</code> and the <code>IstAbfahrtPrognose</code> can also be omitted. In the case of <code>Unbekannt</code>, there will only be a scheduled time; with <code>Prognose</code>, the forecast time = scheduled time.</p> <p>The disadvantage of the forecast status <code>Unbekannt</code> is that all preceding times (incl. Real Times) have to be deleted; this status should, therefore, only be used in absolutely essential instances.</p>

3.2. Special case 'Extraordinary Transit' (`Durchfahrt=true`)

If the element `Durchfahrt` is transmitted together with `true`, the data will be transmitted as if the vehicle had stopped. However, in such an instance, the VDV leaflet does not precisely define which times and which forecast status has to be set. If there are events available which can be transmitted immediately, the forecast status `Real` must be used; in all other cases, `Prognose`, `Geschaetzt` or, in exceptional cases, `Unbekannt` can also be transmitted.

Arrival, departure and transit events can mostly be transmitted, even in the case of a transit, by entry and exit signals or catchment circles. If the arrival and departure events at a station stop are ascertained from the door opening signals, then these may well not be available in the case of a transit; hence, there will be no Real Times. The message will then only be triggered by the next message-triggering event (see Section 6.1.4) or by the next arrival or departure event at a subsequent station stop. This could lead to it not being possible to trigger the deletion of a message on a display board immediately on departure.

3.3. Special case 'Request stop'

If the vehicle does not stop at a 'Request stop', then the ITCS must behave as though the vehicle had stopped. In this instance, the journey must be immediately deleted from the display board. Otherwise, its behaviour will correspond to that described in Section 3.2.

4. Glossary

Term	Description
DFI	Dynamic passenger information: provides the operational exchange of data related to passenger information
ITCS	Intermodal Transport Control System (synonym for RBL/computer-assisted control system)
Real time	The effective time at which, as regards a particular journey, an arrival or a departure took place.
SKI	Lead system for customer information

5. Sections and documents referred to

5.1. Further information about forecast status in the VDV document

References to VDV Document 454 [3]:

1. Section 5.2.1 (AboAus, MitRealZeiten)
2. Section 5.2.2.3 (IstHalt, IstAnkunftPrognoseStatus, IstAbfahrtPrognoseStatus)
3. Section 6.1.2 (Supplementary rule regarding the delay profile, updating rule)
4. Section 6.1.7 (Initial message and preview time)
5. Section 6.1.10 (Forecast recall/journey re-set)
6. Section 6.1.11 (Explanation of the actual arrival and departure times)
7. Section 6.1.15 (Ensuring plausible forecasts)

5.2. Documents referred to

- [1] Verband Deutscher Verkehrsunternehmen VDV; Association of German Transport Companies
VDV Leaflet 453 – Live Data Interface Timetable information Version 2.6,
Cologne (D), 2018
- [2] Verband Deutscher Verkehrsunternehmen VDV; Association of German Transport Companies
XML-Schema VDV453_incl_454_V2017.c.xsd (Version: '2017.c'), Cologne (D),
2018 and older versions.
- [3] Verband Deutscher Verkehrsunternehmen VDV; Association of German Transport Companies
VDV Leaflet 454 – Live Data Interface Timetable information Version 2.2,
Cologne (D), 2018 and older versions.

6. Annex

6.1. General information

6.1.1. Arrival/departure events

6.1.1.1. Functional definition

From the functional aspect, arrival and departure events can be defined as follows:

- Arrival: When the first passenger is able to alight at a particular location (in relation to the given journey and station stop); as a general rule, this is the moment when the doors can be opened for the first time. It is irrelevant whether anyone boards or alights at the station stop or whether the doors are opened at all.
- Departure: When the last passenger is able to board at a particular location; as a general rule, this is the moment when the doors are closed for the last time before they are locked. It is irrelevant whether anyone boards or alights at the station stop or whether the doors are opened at all.

In the following special cases, the event is estimated and cannot be explicitly ascertained:

- Transit through a station stop: If the train does not stop at a station stop (e.g. if no request is made to alight or board at a 'Request stop') but only runs past it, then the arrival and/or departure event is measured at a point roughly level with the station stop.
- By-passing a station stop: If the train does not run directly past a station stop but by-passes it, the event is extrapolated.
- An arrival event where alighting is prohibited and a departure event where boarding is prohibited do not necessarily have to be measured.

A couple of things can be deduced from this:

- Every forecast must be aligned to these events.
- The Real Time (live time) only corresponds to explicitly ascertained events

6.1.1.2. Technical implementation

Many transport companies are not technically equipped to ascertain exactly the precise functional arrival and/or departure event. Instead, the best technical solution which permits the least inaccuracy is used. Transport companies are obliged to optimise their ability to ascertain functional events.

Possible arrival events and combinations:

- Door unlocking when stationary
- Entering the catchment circle of a station stop (with minimum inaccuracy)
- Entry signal, rail side (with minimum inaccuracy)
- etc.

Possible departure events and combinations:

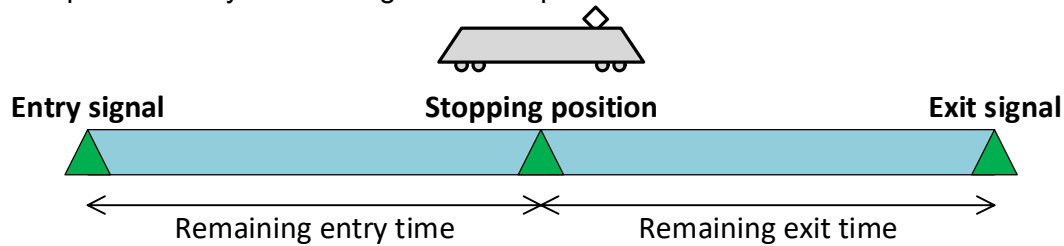
- Door locking when stationary
- Exiting the catchment circle of a station stop (with minimum inaccuracy)
- Exit signal, rail side (with minimum inaccuracy)
- etc.

Making matters more difficult, are other operational situations, such as (these can be partly alleviated by better data provision):

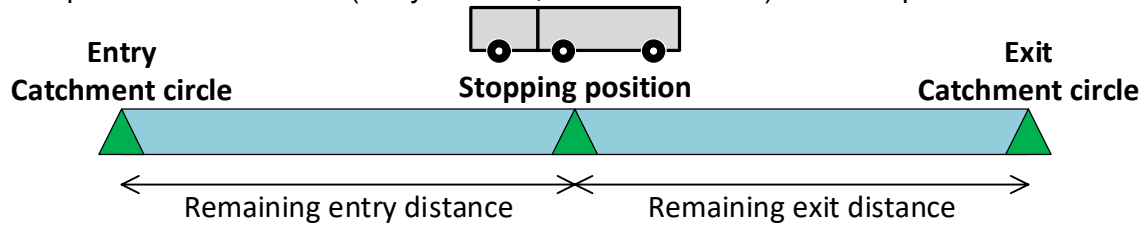
- Actuation of the light signalling system by means of the door locking button → if the green phase is missed, the door locking button must be operated once again (rapid Open/Close)
- Pulling forward at a continuous platform

- Leaving the catchment circle to facilitate overtaking at the station stop
- Stopping before the catchment circle because the stopping bay is more than fully occupied
- Doors must be locked so that the doors actually close (e.g. when waiting at a stop in winter)
- etc.

Example with entry and exit signal at a stop:



Example: Catchment circle (entry and exit, catchment circle) at the stop:



Real Times can be calculated as follows:

- Arrival time at the stopping position for an arrival event = 'Time at the entry signal' + 'Remaining entry time'
- Departure time at the stopping position for a departure event = 'Time at the exit signal' + 'Remaining exit time'

Arrival and departure events will only be triggered if Real Times are known, allowing the position of the vehicle to be transmitted immediately it arrives or departs and, for example, updating a display board with all the essential events.

6.1.2. Forecast times

VDV Leaflet 454 frequently mentions forecast time. By forecast time, VDV Leaflet 454 basically means the `IstAnkunftPrognose` and `IstAbfahrtPrognose` elements. If these elements are omitted in the AUS service transmission, then the forecast or the actual times correspond to the scheduled times ('arrival time', 'departure time') except when the status is `Unbekannt`. In such cases, the scheduled times automatically become forecast times and actual times.

6.1.3. Actual arrival and departure times

What the leaflet has to say about the difference between the forecast status `Real` and the forecast status `Geschaetzt` is open to different interpretations. The preceding sections have illustrated the difference and have made clear how they are to be used by Swiss public transport companies.

6.1.3.1. Forecast status=Real

Actual arrival and departure times are taken to mean the Real Times of arrivals or departures which have already taken place, where an arrival or departure event can be triggered and where a Real Time can be directly/immediately transmitted with the forecast status `Real` and is then actually transmitted using `MitRealZeiten=true`.

Quotation from VDV Leaflet 454, Section 6.1.11 referring to 'Forecast status=Real':

... The actual times are announced in the `IstHalt` element under the `IstAbfahrtPrognose` or the `IstAnkunftPrognose` sub-element, and identified by the `IstAbfahrtPrognoseStatus=Real` or the `IstAnkunftPrognoseStatus=Real` element.

...

The ITCS transmits an actual time as soon as the event (arrival at or departure from the station stop) occurs. As regards complete journey messages, the actual times for those station stops which have already been passed will be shown. Actual times will, by their very nature, not be updated. The actual time per station stop and event (arrival or departure) will only be transmitted once (and possibly once more as part of complete journey messages).

...

If, at the start of the lifecycle of a new subscription, all current journeys are transmitted, then the ITCS must, in respect of every journey, also include the actual times for those stops which have already taken place. ...

6.1.3.2. Forecast status=Geschaetzt

The forecast status `Geschaetzt` is not about Real Times or 'actual arrival and departure times'. Neither is an arrival or departure event triggered for this status. Consequently, `Geschaetzt` is not an imprecise Real Time but a forecast or estimated time which lies in the past. The leaflet does not specify more precisely the time when estimated times should be transmitted; that time thus equates to the next message-triggering event (see Section 6.1.4). It may well be that no further event is triggered; therefore, neither the transmission nor the time of the transmission can be relied upon.

According to VDV Leaflet 454, instead of using the forecast status `Geschaetzt`, `Prognose` can always be used, i.e. it is not essential for the forecast status `Geschaetzt` to be transmitted. It must therefore be assumed that some systems will never transmit the forecast status `Geschaetzt`. This means that `Geschaetzt` should not, by itself, be used to control technical systems or display boards.

6.1.4. Message-triggering events

VDV Leaflet 454 defines many events which can trigger a message. Some of these events are shown in the list below:

1. If hysteresis occurs
2. If a preview time is shown (not always absolutely essential)
3. Attribute changes
 - a. Change of a stop point within a station stop (the `HaltID`)
 - b. Formation change
 - c. A change to the wording of the journey/station stop information
 - d. A change to the wording of the direction information
 - e. A change to the how full/empty the service is
 - f. etc.
4. Route changes
 - a. Partial cancellation
 - b. Diversion
 - c. etc.
5. Complete cancellation of a journey (only possible prior to the start of the journey)
6. Transmission of a new, additional journey
7. Breakdown of data transmission (`PrognoseMoeglich=false`)
8. Restoration of data transmission (`PrognoseMoeglich=true`)
9. etc.

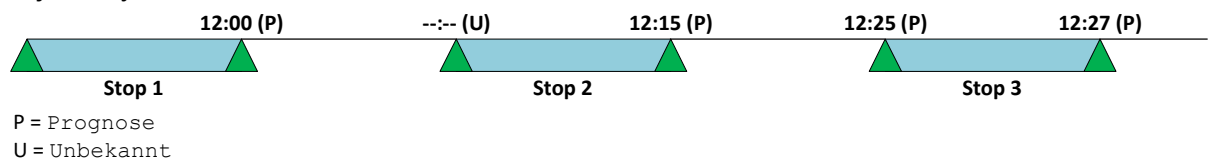
If `MitRealZeiten=true` is used, the arrival and departure events will also be included; see also Section 6.1.

6.1.5. Times in ascending order after passing a particular point

This section is linked to Section 6.1.15 (ensuring plausible forecasts) which should be read first.

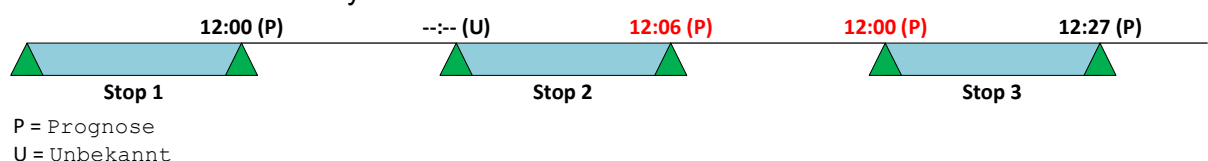
Correct:

An arrival or departure with the forecast status `Unbekannt` (U) does not have a time or a scheduled time. Consequently, they can never upset the ascending order even in the middle of a journey.



Incorrect:

It cannot ever be the case that in real time (forecast) a vehicle departs from a station stop earlier than it arrives or that it arrives at the next station stop earlier than it departs from the previous one (see the times marked red). Times not shown in ascending order after passing a particular point could lead to problems with routing or with displaying information about connections in the information systems.



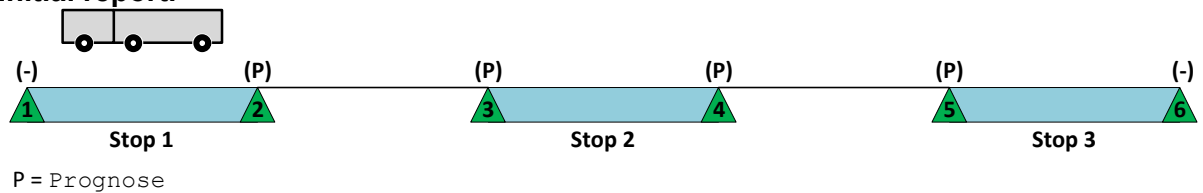
The drawback of sorting in an ascending order is that, even when the control system does not know any times, nonetheless a forecast time has to be transmitted. If, subsequently, this varies greatly from the true situation, passengers may be confused or even miss the journey they planned to take.

6.2. Examples `MitRealZeiten=true`

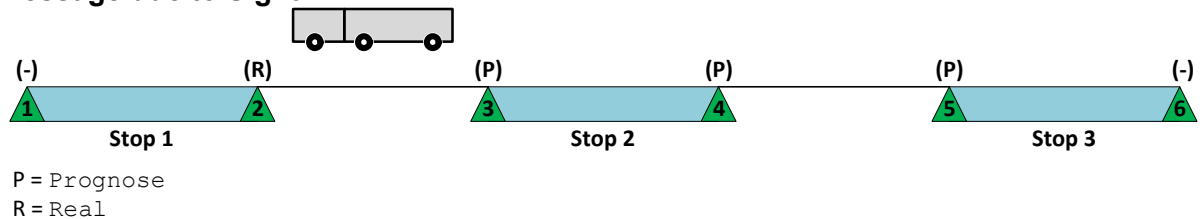
6.2.1. Example 1: Standard case

All events are triggered and a message is always sent immediately.

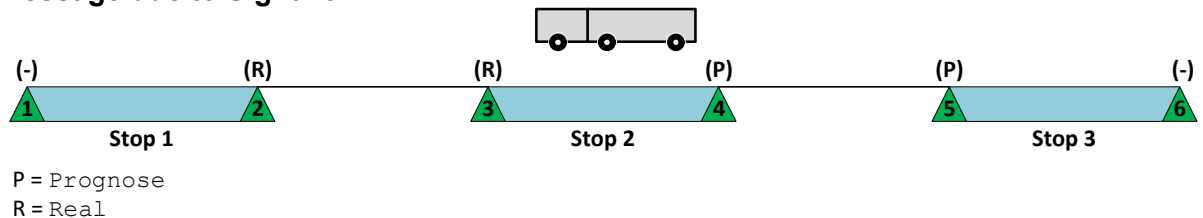
Initial report:



Message due to Signal 2:



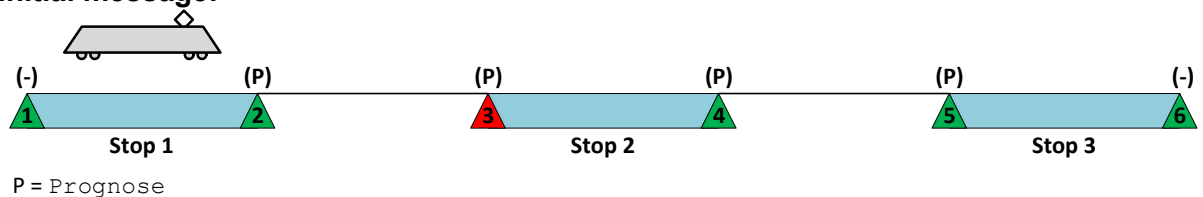
Message due to Signal 3:



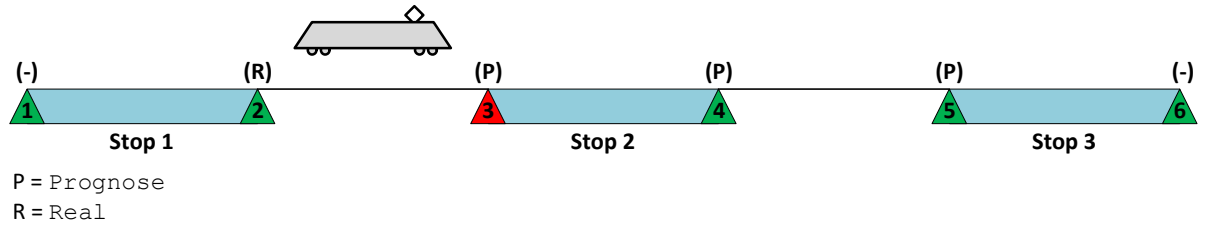
6.2.2. Example 2: Arrival event 3 does not take place

The arrival event at Signal 3 has a problem and is not triggered. After Signal 4 has been passed, the forecast status `Prognose` can be transmitted for Signal 3.

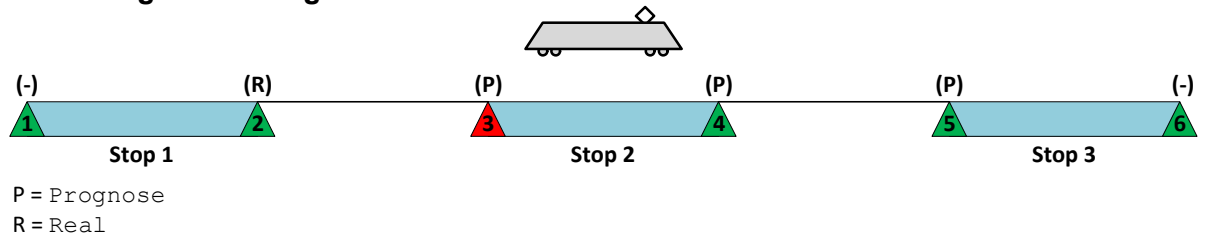
Initial message:



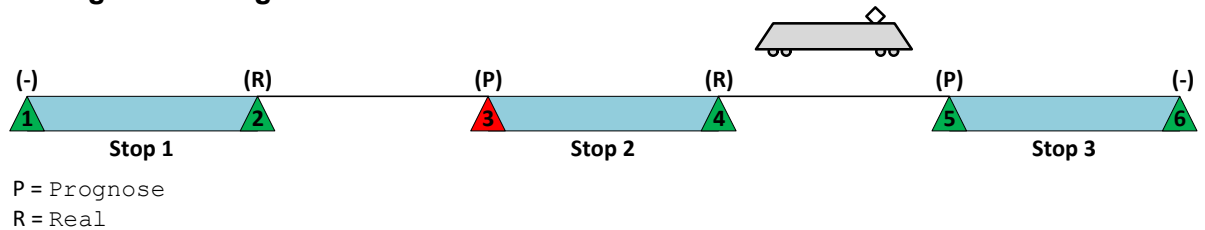
Message due to Signal 2:



No message due to Signal 3:



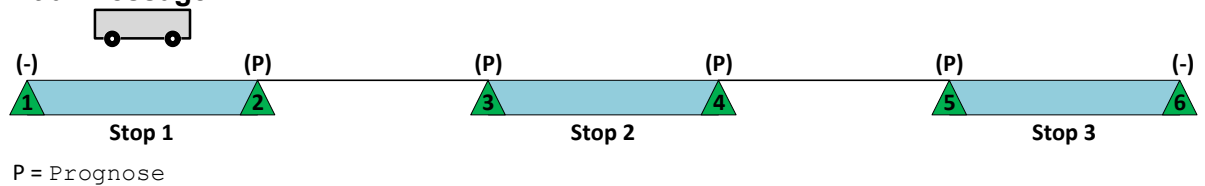
Message due to Signal 4:



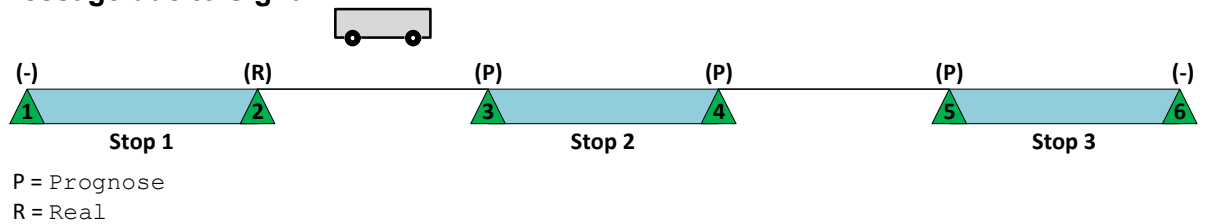
6.2.3. Example 3: Arrival signal 3 does not take place due to a communications dead spot

The arrival event at Signal 3 is transmitted with a delay due to a communications dead spot. After Signal 4 has been passed, the forecast status *Prognose* can be transmitted on behalf of Signal 3 because the vehicle knows these times.

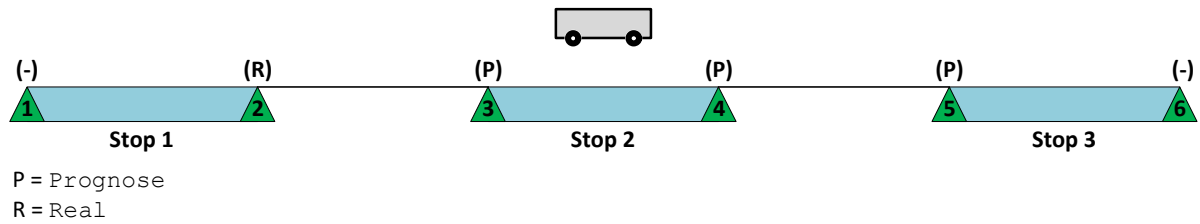
Initial message:



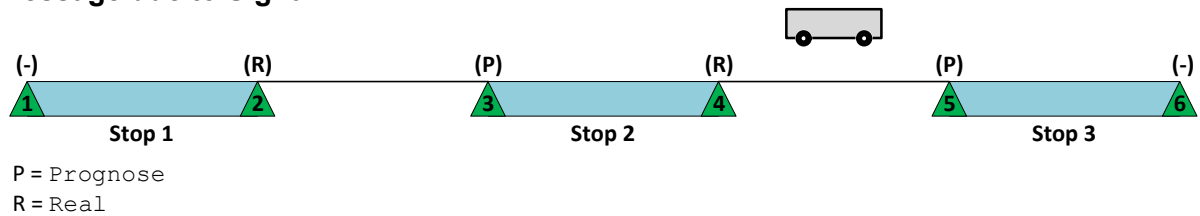
Message due to Signal 2:



No message due to a communications dead spot:



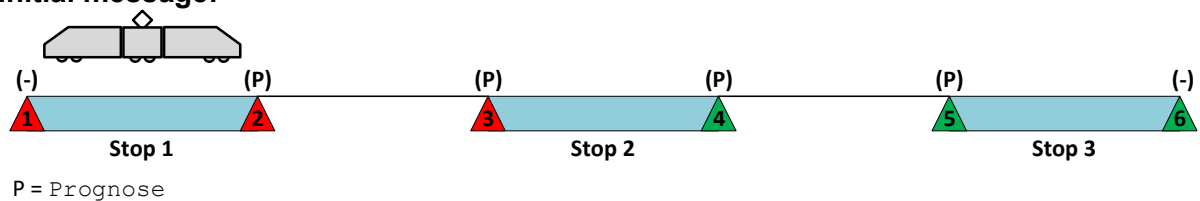
Message due to Signal 4:



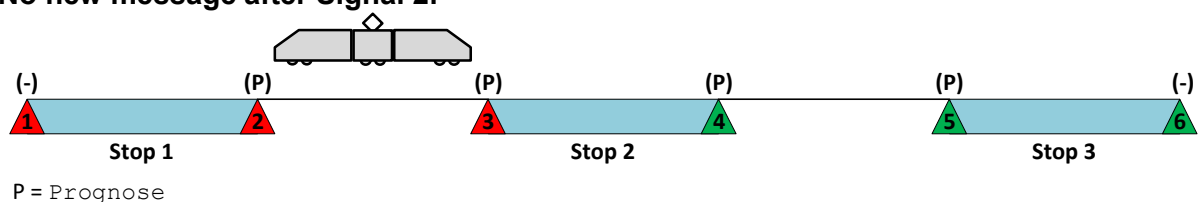
6.2.4. Example 4: Signals 1-3 are not working; messages are sent

The events at Signals 1 to 3 are not working. All the other signals and the link to the ITCS are working. Forecast times can be transmitted if hysteresis occurs or if attributes change. From Signal 4 onwards, all signals are working; forecast times for Signals 1 to 3 are not known.

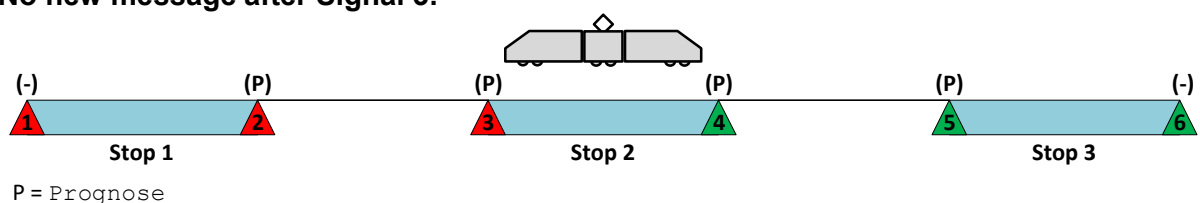
Initial message:



No new message after Signal 2:

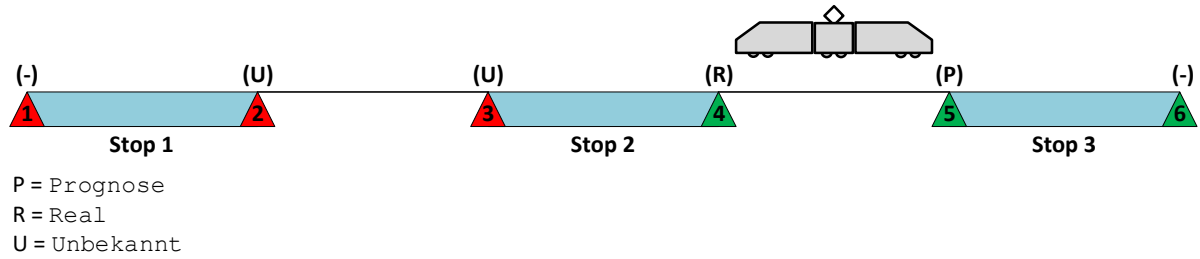


No new message after Signal 3:



Message due to Signal 4:

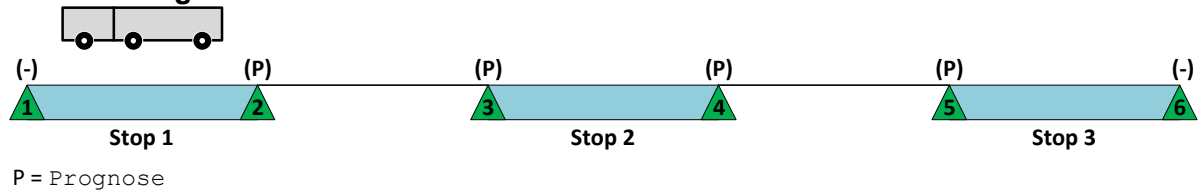
If the forecast times are reliable, the *Unbekannt* can be transmitted as *Prognose*.



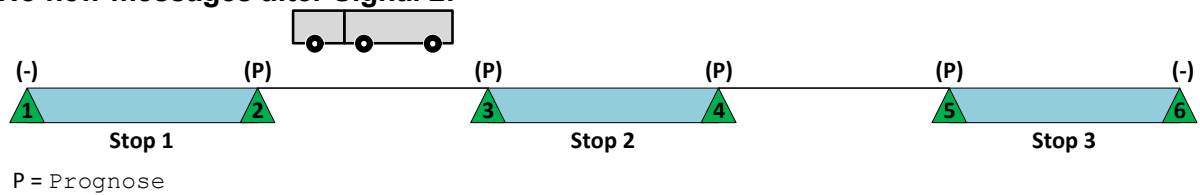
6.2.5. Example 5: Messages only from Signal 4 onwards

All the signals are working but the link to the ITCS only works from Signal 4 onwards. No messages can be transmitted until Signal 4 has been passed. Forecast times for Signals 1 to 3 are not known.

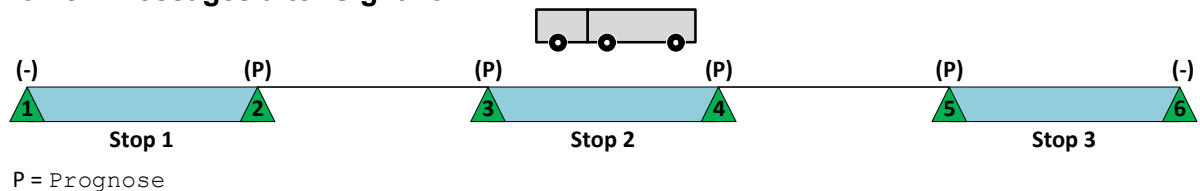
Initial message:



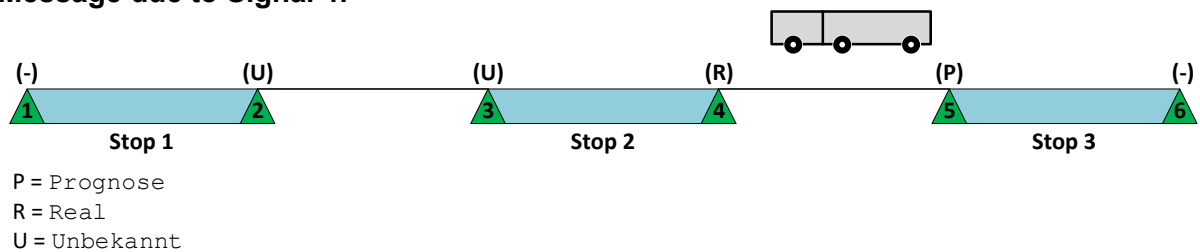
No new messages after Signal 2:



No new messages after Signal 3:



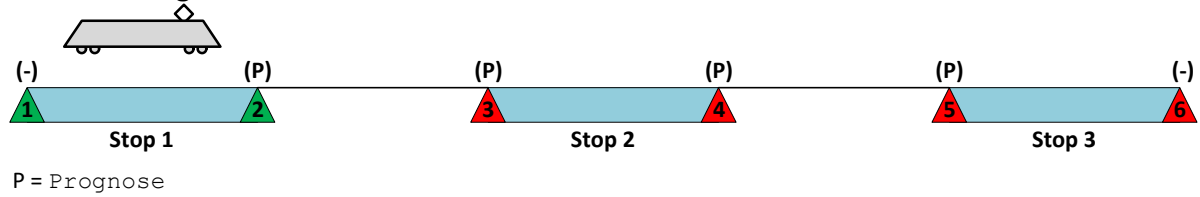
Message due to Signal 4:



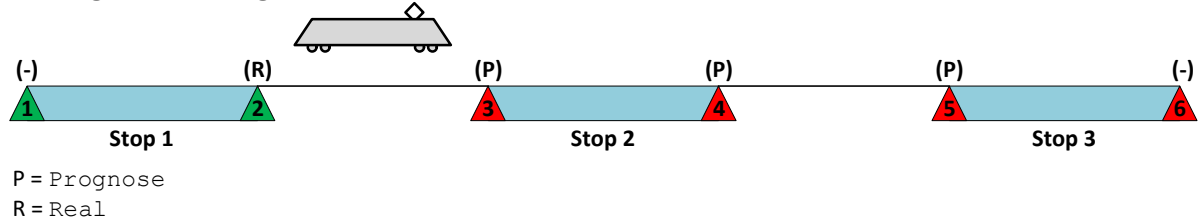
6.2.6. Example 6: No more messages from Signal 3 onwards

No more events are triggered from Signal 3 onwards. A forecast can be transmitted for subsequent station stops.

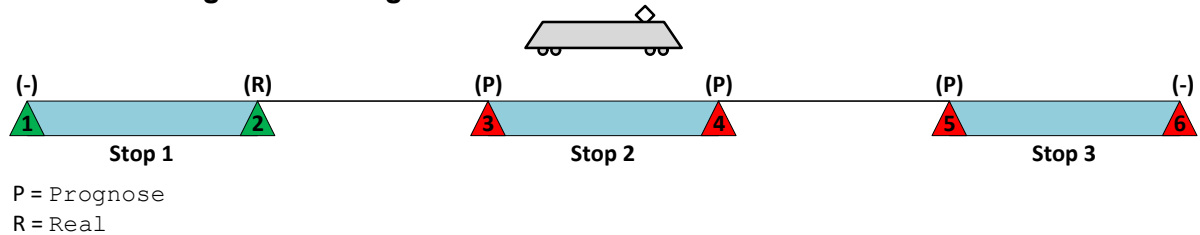
Initial message:



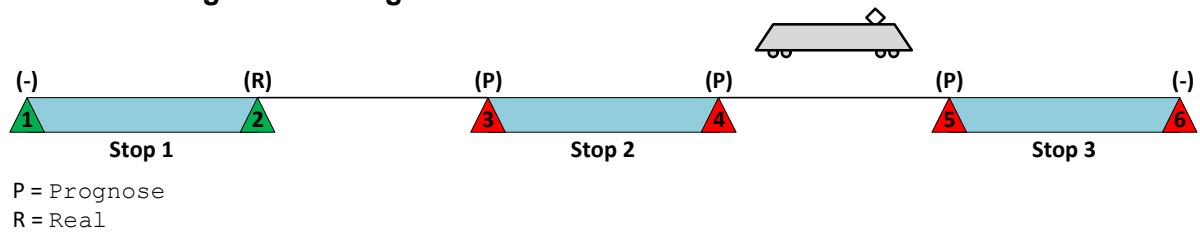
Message due to Signal 2:



No new messages due to Signal 3:



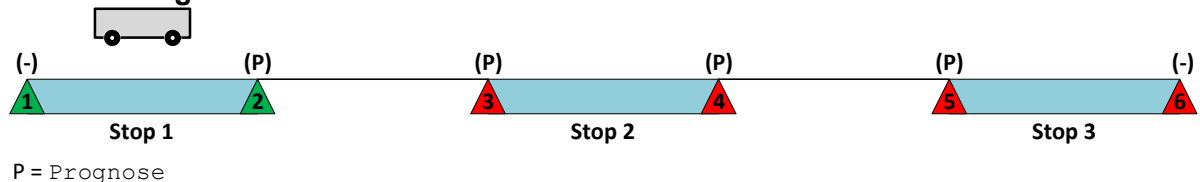
No new messages due to Signal 4:



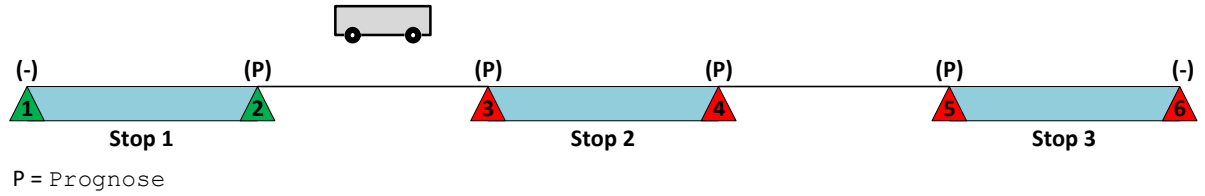
6.2.7. Example 7: New journey without real time data reported

No real time data are available for this new journey. PrognoseMoeglich=false should also be set.

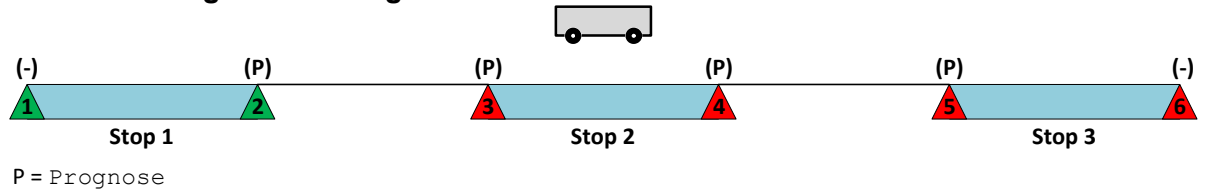
Initial message:



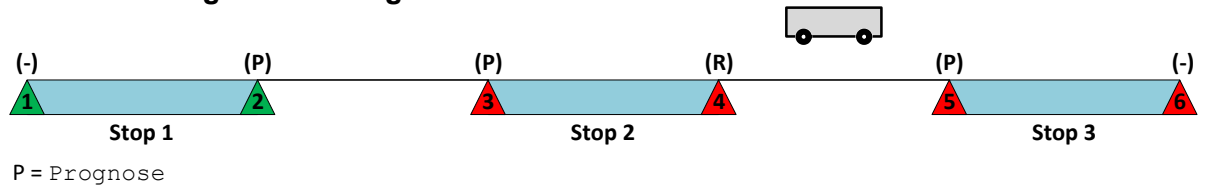
No new messages due to Signal 2:



No new messages due to Signal 3:



No new messages due to Signal 4:

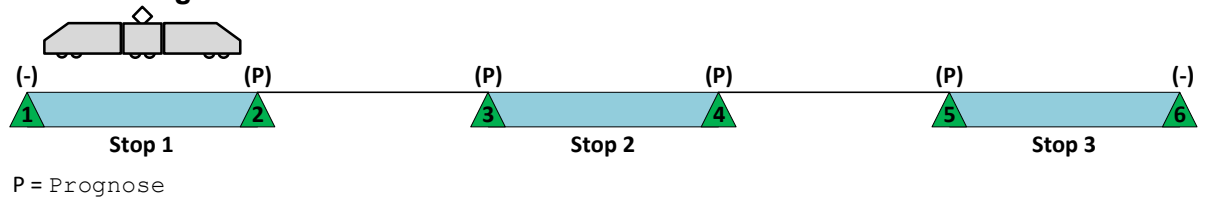


6.3. Examples MitRealZeiten=false

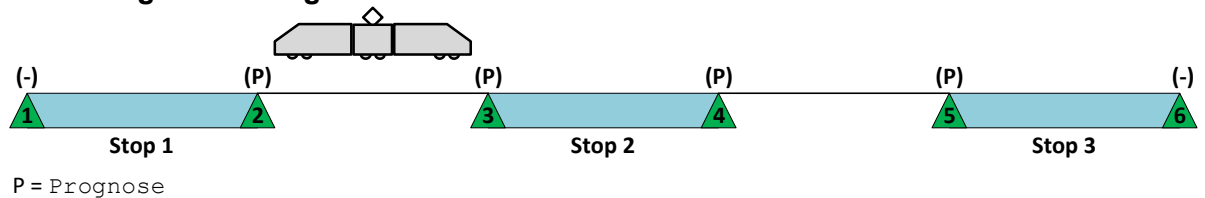
6.3.1. Example 1: Standard case

All events are triggered. Messages are not sent immediately following an arrival or departure event but only after another message-triggering event (see Section 6.1.4).

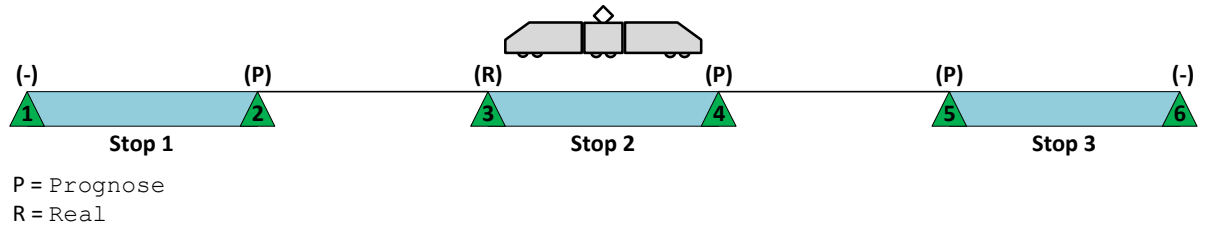
Initial message:



No message due to Signal 2:



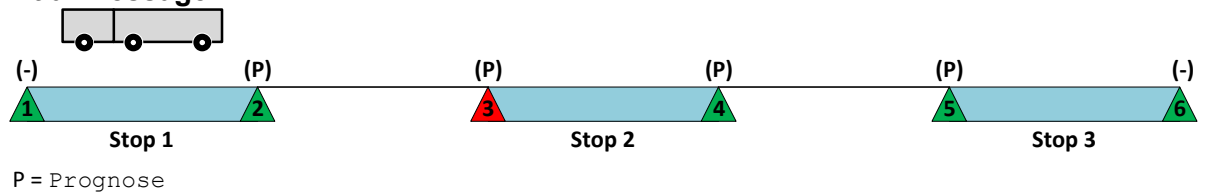
Message due to hysteresis after Signal 3:



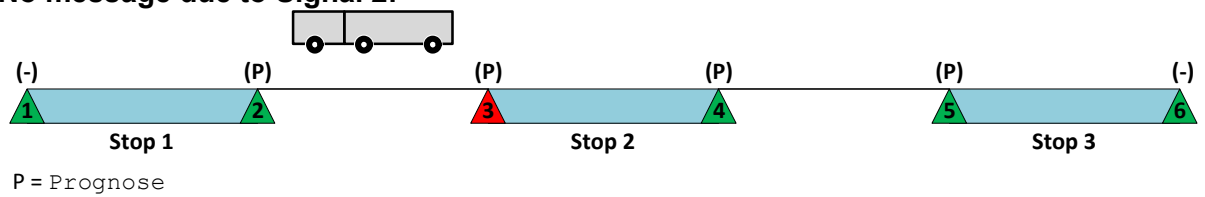
6.3.2. Example 2: Arrival signal 3 does not take place

The arrival event at Signal 3 has a problem and is not triggered. If another message-triggering event occurs (see Section 6.1.4) after Signal 4 has been passed, the forecast status *Prognose* can be sent on behalf of Signal 3.

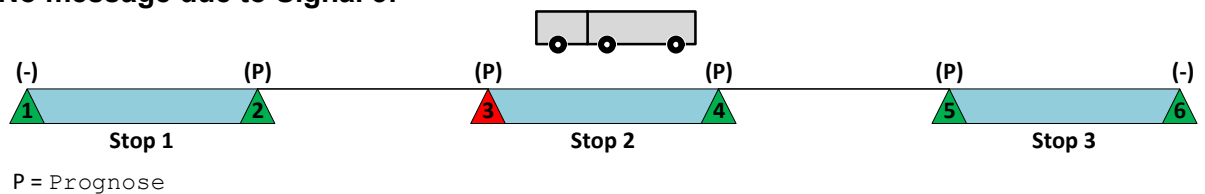
Initial message:



No message due to Signal 2:



No message due to Signal 3:



Message due to hysteresis after Signal 4:

